Tarea5.1

Ejercicios

Analice los distintos parámetros que permiten calibrar el modelo de estimación COCOMO II:

$$esfuerzo = 2.94 * KSLOC^{0.91+0.01 \sum_{j=1}^{5} SF_j} * \prod_{i=1}^{17} EM_i$$

- 5 factores de escala [SF: scale factors]
- 17 multiplicadores de esfuerzo [EM: effort multipliers]

Scala Factors:

The application size exponent is aggregated of five scale factors (SF) that describe relative economies or diseconomies of scale that are encountered for software projects of dissimilar magnitude. A project exhibits economy of scale if the exponent is less than one i.e. effort is non-linearly reduced. Economies and diseconomies of scale are in balance should the exponent hold a value of one. A project exhibits diseconomy of scale if the exponent is more than one i.e. effort is non-linearly increased. These are:

- **Scala Factor PREC**

- Feature	Very Low	Nominal/High	Extra High
Organizational understanding of product objectives	General	Considerable	Thorough
Experience in working with related software systems	Moderate	Considerable	Extensive
Concurrent development of associated new hardware and operational procedures	Extensive	Moderate	Some
Need for innovative data processing architectures, algorithms	Considerable	Some	Minimal

Scale Factors for COCOMO.II Early Design and Post-Architecture Models

PREC Descriptors	thoroughly unprecedented	largely unprecedented	somewhat unprecedented	generally familiar	largely familiar	thoroughly familiar
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Value	6.20	4.96	3.72	2.48	1.24	0.00

- ## **Scala Factor FLEX**

Feature	Very Low	Nominal/High	Extra High
Need for software conformance with preestablished requirements	Full	Considerable	Basic
Need for software conformance with external interface specifications	Full	Considerable	Basic
Combination of inflexibilities above with premium on early completion	High	Medium	Low

- Scale Factors for COCOMO.II Early Design and Post-Architecture Models

FLEX Descriptors	rigorous	occasional relaxation	some relaxation	general conformity	some conformity	general goals
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Value	5.07	4.05	3.04	2.03	1.01	0.00

- ## **Scala Factor RESL**

- Feature	Very Low	Low	Nominal	High	Very High	Extra High
Risk Management Plan identifies all critical risk items, establishes milestones for resolving them by PDR or LCA.	None	Little	Some	Generally	Mostly	Fully

Schedule, budget, and internal milestones through PDR or LCA compatible with Risk Management Plan.	None	Little	Some	Generally	Mostly	Fully
Percent of development schedule devoted to establishing architecture, given general product objectives.	5	10	17	25	33	40
Percent of required top software architects available to project.	20	40	60	80	100	120
Tool support available for resolving risk items, developing and verifying architectural specs.	None	Little	Some	Good	Strong	Full
Level of uncertainty in key architecture drivers: mission, user interface, COTS, hardware, technology, performance.	Extreme	Significant	Considerable	Some	Little	Very Little
Number and criticality of risk items.	> 10 Critical	5-10 Critical	2-4 Critical	1 Critical	> 5 Non-Critical	< 5 Non-Critical

Scale Factors for COCOMO.II Early Design and Post-Architecture Models

RESL Descriptors	little (20%)	some (40%)	often (60%)	generally (75%)	mostly (90%)	full (100%)
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Value	7.07	5.65	4.24	2.83	1.41	0.00

- **Scala Factor TEAM**

- Characteristic	Very Low	Low	Nominal	High	Very High	Extra High
Consistency of stakeholder objectives and cultures	Little	Some	Basic	Considerable	Strong	Full
Ability, willingness of stakeholders to accommodate other stakeholders' objectives	Little	Some	Basic	Considerable	Strong	Full
Experience of stakeholders in operating as a team	None	Little	Little	Basic	Considerable	Extensive
Stakeholder teambuilding to achieve shared vision and commitments	None	Little	Little	Basic	Considerable	Extensive

Scale Factors for COCOMO.II Early Design and Post-Architecture Models

TEAM Descriptors	very difficult interactions	some difficult interactions	basically cooperative interactions	largely cooperative	highly cooperative	seamless interactions
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Value	5.48	4.38	3.29	2.19	1.10	0.00

- **Scala Factor PMAT**

Overall Maturity Level:

- CMM Level 1 (lower half)
- CMM Level 1 (upper half)
- CMM Level 2
- CMM Level 3
- CMM Level 4
- CMM Level 5

Scale Factors for COCOMO.II Early Design and Post-Architecture Models

PMAT Descriptors	CMM Level 1 (lower half)	CMM Level 1 (upper half)	CMM Level 2	CMM Level 3	CMM Level 4	CMM Level 5
Rating Levels	Very Low	Low	Nominal	High	Very High	Extra High
Value	7.80	6.24	4.68	3.12	1.56	0.00

Scale Factor	Description
Precedentedness (PREC)	Reflects the previous experience of the organization.
Development Flexibility (FLEX)	Reflects the degree of flexibility in the development process.
Risk Resolution (RESL)	Reflects the extent of risk analysis carried out.
Team Cohesion (TEAM)	Reflects how well the development team knows each other and work together.
Process Maturity (PMAT)	Reflects the process maturity of the organization.

Effort multipliers

Seventeen Post-Architecture (EM) effort multipliers are used in the COCOMO II model to adjust the nominal, person-month effort in software product development. They are the following:

- **Product attributes**
  - ➢ Required Software Reliability(RELY)
  - ➢ Database size(DATA)
  - ➢ Product Complexity(CPLX)
- **Computer attributes**
  - ➢ Execution Time Constraint(TIME)
  - ➢ Main Storage Constraint(STOR)
  - ➢ Virtual Machine Volatility(VIRT)
  - ➢ Computer Turnaround Time(TURN)
- **Personal attributes**
  - ➢ Analyst Capability(ACAP)
  - ➢ Application Experience(AEXP)
  - ➢ Programmer Capability(PCAP)
  - ➢ Virtual Machine Experience(VEXP)
  - ➢ Programming Language Experience(LEXP)
- **Project attributes**
  - ➢ Modern Programming Practices(MODP)
  - ➢ Use Of Software Tools(TOOL)
  - ➢ Required Development Schedule(SCED)

Tarea5.2

Para proyectos del mismo tamaño (en KSLOC), compruebe el efecto que tiene el ajuste de dichos parámetros en diferentes escenarios. En particular, realice estimaciones para los siguientes proyectos:

1- Aplicación web desarrollada por un equipo experimentado en el uso de las herramientas necesarias para el proyecto.

> ### Scala Factors

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC					X	
FLEX			X			
RESL			X			
TEAM					X	
PMAT			X			

> ### Effort multipliers

			Product			
Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
RELY	X					
DATA			X			
CPLX			X			

			Computer			
Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
TIME			X			
STOR			X			
VIRT					X	
TURN		X				

			Personal			
Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High

	Very Low	Low	Nominal	High	Very High	Extra High
ACAP		X				
AEXP					X	
PCAP			X			
VEXP				X		
LTEX				X		

			Project			
Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
TOOL				X		
MODP		X				
SCED		X				

2- Middleware de alto rendimiento para la construcción de sistemas distribuidos heterogéneos

➢ **Scala Factors**

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
PREC					X	
FLEX			X			
RESL			X			
TEAM					X	
PMAT			X			

➢ **Effort multipliers**

			Product			

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
RELY		X				
DATA			X			
CPLX					X	

Computer

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
TIME					X	
STOR					X	
VIRT				X		
TURN		X				

Personal

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
ACAP		X				
AEXP		X				
PCAP	X					
VEXP		X				
LTEX				X		

Project

Scala Factors	Very Low	Low	Nominal	High	Very High	Extra High
TOOL					X	
MODP		X				
SCED		X				

Tarea5.3

Parámetro	Web App	Middleware	Hardware
SF$_1$ PREC	1.24	3.72	6.2
SF$_2$ PREC	3.04	3.04	4.05
SF$_3$ PREC	4.24	4.24	2.83
SF$_4$ PREC	1.10	3.29	4.38
SF$_5$ PREC	4.68	4.68	4.68
ΣSF$_j$	14.3	18.97	22.14
EM$_1$	0.82	1.0	1.0
EM$_2$	1.0	1.0	1.0
EM$_3$	1.0	1.34	1.34
EM$_4$	1.07	1.07	1.0
EM$_5$	1.11	1.23	---
EM$_6$	1.0	1.11	1.0
EM$_7$	1.0	1.0	1.0
EM$_8$	1.15	1.0	1.15
EM$_9$	1.0	1.0	1.0
EM$_{10}$	---	1.0	1.0
EM$_{11}$	0.9	1.12	0.9
EM$_{12}$	0.81	1.0	1.22
EM$_{13}$	0.85	1.0	1.19
EM$_{14}$	0.84	0.91	1.09
EM$_{15}$	0.78	0.9	1.0
EM$_{16}$	1.0	1.22	1.0
EM$_{17}$	1.0	1.0	1.0
ΠEM$_i$	0.45	2.19	2.19

Tarea5.3

Ejercicios

Utilizando la expresión general del modelo COCOMO II

$$esfuerzo = 2.94 * KSLOC^{0.91+0.01\sum_{j=1}^{5} SF_j} * \prod_{i=1}^{17} EM_i$$

estime el esfuerzo necesario para desarrollar un proyecto de 10 KSLOC, 100 KSLOC y 1000 KSLOC en cada uno de los escenarios anteriores y rellene la siguiente tabla:

Tamaño	Web App	Middleware	Hardware
10 KSLOC	XX p.m.	XX p.m.	XX p.m.
100 KSLOC	XX p.m.	XX p.m.	XX p.m.
1000 KSLOC	XX p.m.	XX p.m.	XX p.m.

Tamaño	Web App	Middleware	Hardware
10 KSLOC	14.94 p.m	81.0 p.m	87.13 p.m
100 KSLOC	168.87 p.m	1019.0 p.m	1179.2 p.m
1000 KSLOC	1907.91 p.m	12820.1 p.m	15958.47 p.m

References

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